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Psychosocial determinants of metabolic disorders in individuals with psychiatric disorders

Psychospołeczne uwarunkowania zaburzeń przemiany metabolicznej u osób chorujących psychicznie

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Abstract

Aim of the study: The analysis of metabolic disorders in people with mental disorders due to psychological factors, healthy and unhealthy behaviour as well as the material situation and employment status. **Material and methods:** Ninety-one adults diagnosed with a mental disorder who use community support centres, whose metabolic rates were examined with the use of the waist-to-hip ratio (WHR) indicator, total cholesterol, LDL cholesterol, triglycerides, HDL cholesterol and glucose concentration. Cognitive function examinations were performed by using various testing methods to assess general cognitive function, direct and delayed memory, verbal fluency (letter and semantic). Additionally, a test to determine the severity of depression, and also a sociodemographic survey were performed. **Results:** Cigarette smoking was associated with a decrease of cognitive functions ($p < 0.01$) and letter fluency ($p < 0.04$). Physically active people have lower WHR indicators ($p < 0.008$), decreased severity of depressive symptoms ($p < 0.002$) and a lower rate of hospitalisations ($p < 0.001$). They achieved better results in terms of short-term memory ($p < 0.02$) than physically inactive people. People employed in sheltered work conditions had lower rates of abdominal obesity WHR ($p < 0.01$), and achieved better results in the tests measuring their general cognitive functions – Short Test of Mental Status ($p < 0.02$). **Conclusions:** Cigarette smoking, low physical activity, and a lack of employment are associated with metabolic rate disorders, especially in relation to the indicators of overweight and obesity, as well as the general decrease in cognitive functions and the ability of learning and memorisation.

Key words: indicators of metabolic rate, cognitive functions, cigarette smoking, physical activity

Streszczenie

Celem badań była analiza wskaźników zaburzeń przemiany metabolicznej u osób chorujących psychicznie z uwzględnieniem czynników psychologicznych, zachowań pro- i antyzdrowotnych, sytuacji materialnej oraz statusu zatrudnienia. **Materiał i metody:** W zakresie przemiany metabolicznej przebadano 91 osób (dorośli) ze zdiagnozowaną chorobą psychiczną korzystających z ośrodków środowiskowego wsparcia; przeanalizowano wyniki dotyczące: wskaźnika otyłości brzusznej WHR (*waist to hip ratio* – stosunek obwodu talii do obwodu bioder), cholesterolu całkowitego, cholesterolu LDL, trójglicerydów, cholesterolu HDL oraz stężenia glukozy we krwi. Badanie funkcji poznawczych przeprowadzono przy użyciu różnych metod służących do badania: ogólnych funkcji poznawczych, pamięci bezpośredniej i odroczonej, fluencji słownej (literowej i semantycznej). Dodatkowo posłużono się testem do badania nasilenia depresji, a także ankietą socjodemograficzną. **Wyniki:** Nikotynizm wiązał się ze spadkiem funkcji poznawczych ($p < 0,01$) oraz fluencji literowej ($p < 0,04$). Osoby aktywne fizycznie miały niższy wskaźnik WHR ($p < 0,008$), mniejsze nasilenie objawów depresyjnych ($p < 0,002$), niższy wskaźnik hospitalizacji ($p < 0,001$) oraz osiągnęły lepsze rezultaty w zakresie krótkotrwałej pamięci bezpośredniej ($p < 0,02$) od osób nieaktywnych fizycznie. Osoby zatrudnione w warunkach chronionych miały niższy wskaźnik otyłości brzusznej WHR ($p < 0,01$) oraz uzyskały lepsze wyniki w teście mierzącym ogólne funkcje poznawcze – Short Test of Mental Status ($p < 0,02$). **Wnioski:** Nikotynizm, niska aktywność fizyczna, brak zatrudnienia wiążą się z zaburzeniami przemiany metabolicznej, szczególnie w odniesieniu do wskaźników nadwagi i otyłości, a także ze spadkiem ogólnych funkcji poznawczych oraz zdolności do uczenia się i zapamiętywania.

Słowa kluczowe: wskaźniki przemiany metabolicznej, funkcje poznawcze, palenie tytoniu, aktywność fizyczna

INTRODUCTION

Individuals with a psychiatric disorder are at risk of social exclusion; therefore they are more vulnerable to social marginalisation (Brzezińska and Zwolińska, 2010). Social exclusion is associated with the phenomenon of stigmatisation that society manifests towards mental disabilities (Teachman *et al.*, 2006), as well as the phenomenon of auto-stigmatization, where a person manifests negative opinions and attitudes towards themselves after hearing the diagnosis of a mental disorder (Corrigan *et al.*, 2012).

Undoubtedly, the situation of people with a psychiatric disorder can be difficult, especially from the perspective of the person's professional, financial and family life. Often, persisting symptoms of the disease make it difficult to meet certain basic life roles, resulting in the need for assistance from others or from support centres functioning in society (Bronowski *et al.*, 2009). In addition, a psychiatric disorder also contributes, secondarily, to the deterioration of health caused by specific and unhygienic lifestyle choices such as a poor diet and cigarette smoking (Scott and Happell, 2011).

Psychiatric disorders, especially severe mental illnesses (SMI), are associated with metabolic disorders, which lead to an increase of adipose tissue, especially in the abdominal region, along with disorders of lipid and carbohydrate metabolism and body weight gain.

In the light of recent studies, the weight gain in patients with metabolic disorders associated with SMI is not only related to treatment with second generation antipsychotic drugs (De Hert *et al.*, 2011a). Nowadays, it is emphasised that there are existing genetic factors related to the manifestations of metabolic disorders in people suffering from a SMI (Bradshaw and Mairs, 2014). Thereby, diseases such as type 2 diabetes and cardiovascular disease (CVD) are the leading metabolic syndrome diseases among people suffering from a mental illness (Correll *et al.*, 2014).

Our own research focused on the psychosocial aspects of metabolic disorder transformations in a group of people covered by a community-based rehabilitation program. In this group of people, due to their primary diseases difficulties in their social functioning were manifested, therefore they benefited

from the support services offered by community-based centres, where some of them took up employment in protected conditions. The primary aim of our research was to analyse healthy and unhealthy behaviours, material situations and employment in protected conditions where indicators of metabolic and cognitive function disorders were present.

MATERIAL AND METHODS

The analysis included 91 patients with a diagnosed psychiatric disorder who were covered by assistance programmes provided by community-based support centres (the average age of 46 years with a *SD* of ± 13.3 years), such as: The Communal Home of Mutual Aid in Lublin and Łęczna, Occupational Therapy Workshops in Lublin and District Vocational Rehabilitation Facility in Łęczna. All individuals provided their written permission to participate in the above project. The research received the approval of the Bioethics Committee of the Medical University in Lublin (Ref. No. KE-0254/101/2013). The sociodemographic characteristics of the participants are presented in Tab. 1.

The group comprised 48 patients with schizophrenia (F20), 3 with schizoaffective disorders (F25), 3 with persistent delusional disorder (F22), 7 with affective bipolar disorder (F31), 6 with depression (F32), 13 with neurotic disorders that are associated with stress and somatoform disorders (F40–F48), 11 with personality disorders and adult behavioural disorders (F60–F69). The participants received neuroleptics, such as atypical antipsychotics (34%), both typical and atypical antipsychotics (30%), typical antipsychotics (14%), and other medication, such as antidepressants, sedatives, sleeping pills, normothymic/antiepileptic drugs (21%). The relationship between antipsychotics and the studied variables (body mass, body mass index – BMI, waist to hip ratio – WHR, cognitive functions) is the subject of another publication.

The participants' BMI was measured, as well as the waist and hip circumference, in order to perform the diagnosis of abdominal obesity with the WHR indicator. In addition, blood samples were collected from the test participants in a fasting state to measure total cholesterol (TC), LDL cholesterol (LDL), triglycerides (TG), HDL cholesterol (HDL)

Gender	Female		Male					
	51	56%	40	44%				
Place of residence	Village		City					
	22	24%	69	76%				
Smoking addiction	Yes		No					
	45	49%	46	51%				
Employed	Yes		No					
	16	18%	75	82%				
Source of income	Salary		Social welfare		Retirement pension		Disability allowance	
	16	17%	6	7%	12 person	13%	57	63%
Educational stage	Elementary		Vocational		Secondary		Post-secondary and higher	
	13	14%	28	31%	29	32%	21	23%

Tab. 1. The sociodemographic data of the respondents

	Subjective assessment					
Material situation	Good		Difficult		Very good	
	46	51%	40	44%	5	5%
Physical activity	Yes		No			
	68	75%	23	25%		
Need for care	Yes		No			
	44	48%	47	52%		
Life resourcefulness	Yes		No			
	57	63%	34	37%		

Tab. 2. A subjective assessment of the current material situation, physical activity and care needs (understood as the individual need of care provided, by other people in terms of everyday needs) and resourcefulness of life (understood as the ability to satisfy higher life needs)

and glucose (GLUC) concentrations. Cognitive function examinations were also performed by using various testing methods such as the Short Test of Mental Status (STMS), Verbal Fluency (VFT) (semantic fluency and letter fluency) and the Rey Auditory Verbal Learning Test (RAVLT), which is an assessment of direct and delayed memory. In addition, The Beck Depression Inventory (BDI) was applied to examine the severity of depressive symptoms. For the purposes of the study, a survey was constructed in order to obtain information related to healthy and unhealthy behaviour, material situation, current treatment, and basic information such as age, gender, occupation, education and place of residence. Statistical analysis was performed with Statistica software, version 12. Hypothesis testing for two variables was carried out with Mann–Whitney *U* test. To compare three groups, statistical analysis was performed with Kruskal–Wallis test for independent samples. Post hoc analyses were performed using the Dunn test. Correlation was calculated using Spearman's rank correlation coefficient. The results were considered significant with the value of $p < 0.05$.

RESULTS

The subjective assessment of the participants' current material situation, resourcefulness of life, physical activity, as well as the ability to independently satisfy the necessities of life is presented in Tab. 2.

The study revealed that smokers scored a lower number of points in the STMS test measuring overall cognitive function ($p < 0.01$). Additionally, smokers achieved worse results in letter fluency ($p < 0.04$).

Interestingly, in terms of gender differences, no relationship in women was found between smoking and abdominal obesity and body mass, and between smoking and cognitive function. Male smokers, however, were shown to have a higher body mass index ($p < 0.03$), score worse in the letter fluency test ($p < 0.002$), yet cope better in the test measuring direct memory ($p < 0.04$).

Individuals who described themselves as physically active (physical activity defined as minimum walking time of 30 minutes a day) had a lower WHR indicator ($p < 0.008$),

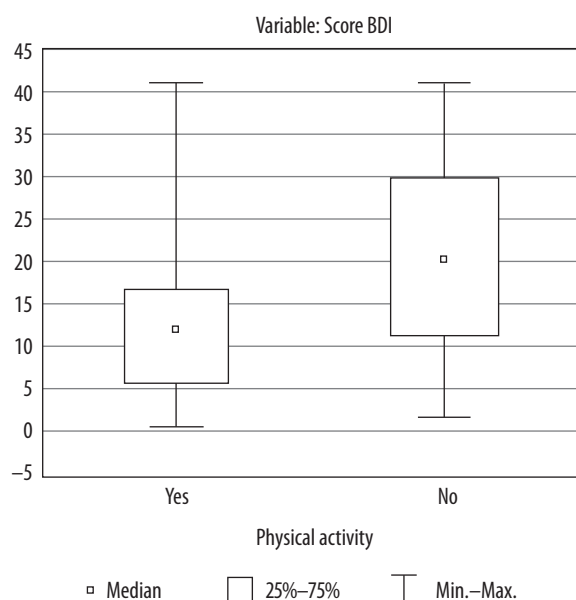


Fig. 1. Physical activity and Beck Depression Inventory results ($p < 0.001$)

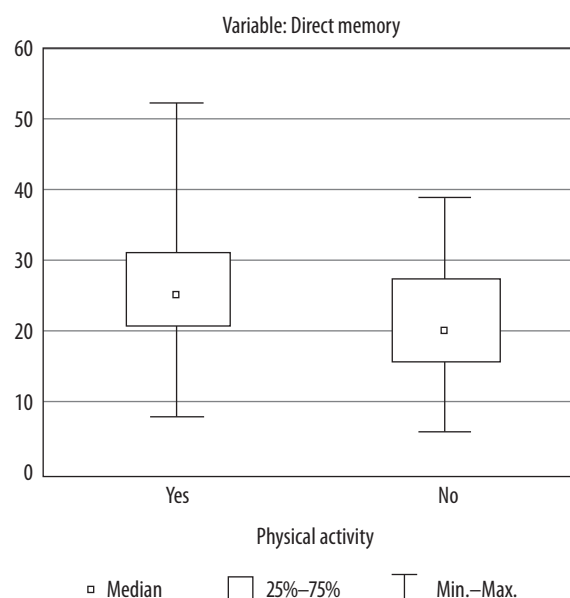


Fig. 2. Physical activity and direct memory (RAVLT) ($p < 0.02$)

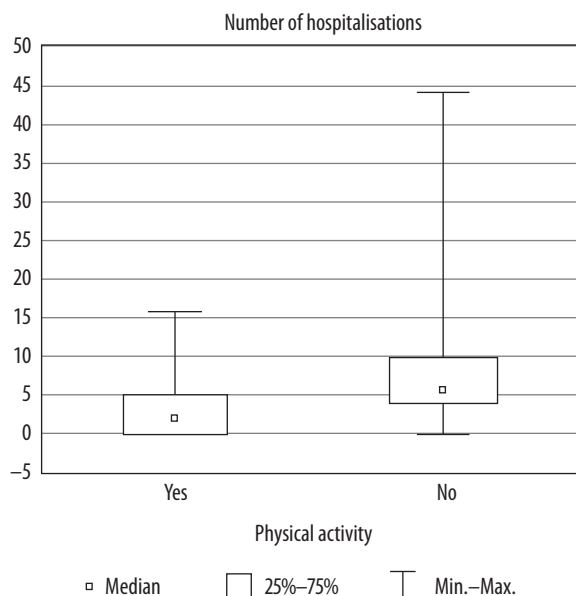


Fig. 3. Physical activity and the number of hospitalisations ($p < 0.001$)

and achieved better results in terms of short-term memory ($p < 0.02$). Additionally, they were characterised by fewer points obtained in the BDI scale ($p < 0.002$). Interestingly, the total number of hospitalisations was lower than the number of physically inactive people ($p < 0.001$) (Figs. 1–4).

Sociodemographic data in relation to body mass indexes and cognitive function

No differences were found between the inhabitants of rural areas and cities in terms of abdominal obesity, body mass and cognitive functions. The analysis took into account the

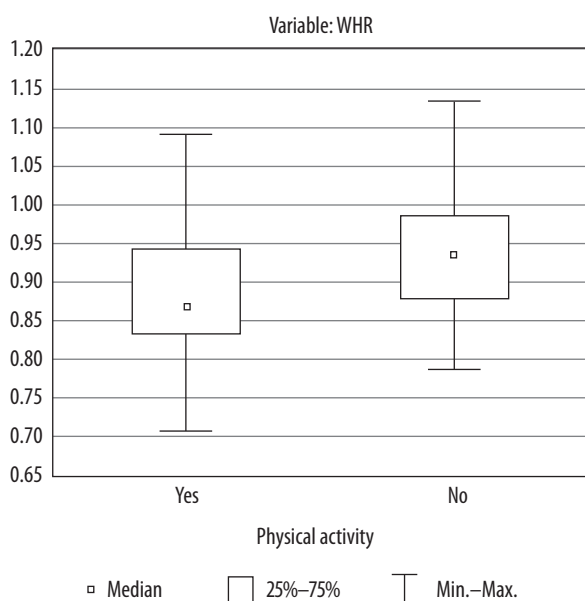


Fig. 4. Physical activity and the WHR indicator ($p < 0.001$)

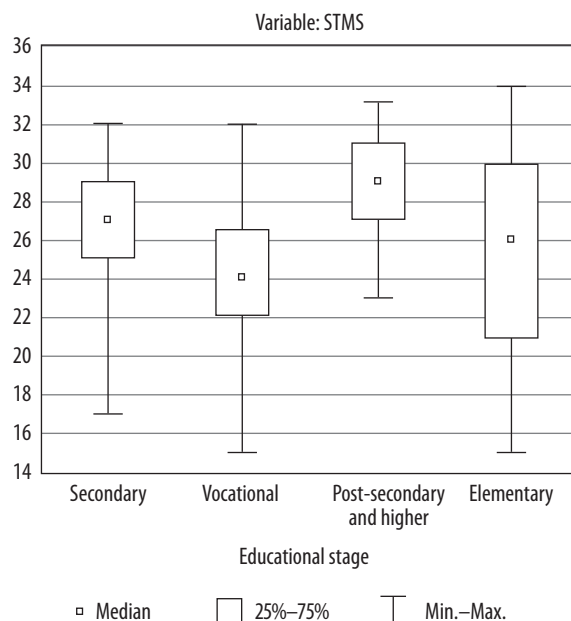


Fig. 5. Educational stage and the general cognitive function (STMS) ($p < 0.0009$)

subjective assessment of the participant's situation, with the exception of the respondents assessing their financial situation as very good, since there were only 5 persons. It was shown that those who assessed their economic situation as good ($n = 46$) performed better in a trial measuring general messages in the STMS test than people perceiving their situation as difficult ($n = 40$), ($p < 0.004$). People who believe they need daily care ($n = 44$) did worse in the trial measuring overall cognitive function than people who believe they do not need assistance ($n = 47$) ($p < 0.03$). In addition, they scored less points in the test measuring delayed memory ($p < 0.04$). Additionally, the participants perceiving

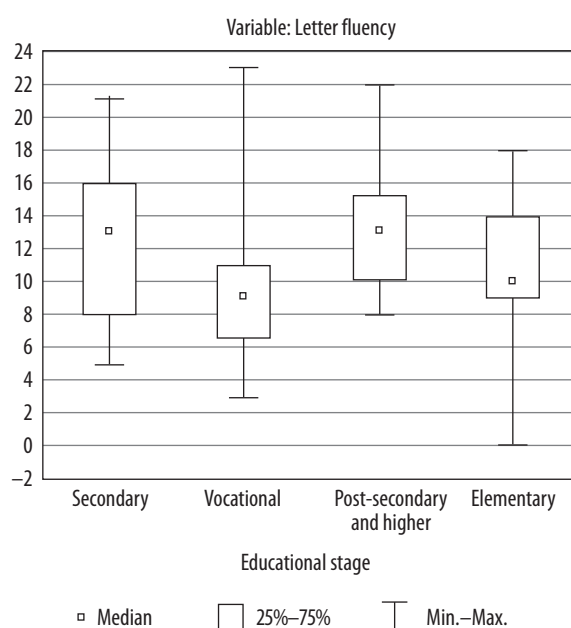


Fig. 6. Educational stage and letter fluency ($p < 0.004$)

themselves as resourceful in life achieved more points in the test measuring direct memory ($n = 57, p < 0.01$).

Education, metabolic disorders and cognitive function

There were no statistically significant differences between the indicators of metabolic rate and the level of education. However, as expected, people with post-secondary or higher education achieved better results in terms of general cognitive function in STMS ($p < 0.0009$) and letter fluency ($p < 0.04$) (Figs. 5, 6).

Employment in protected conditions and disorders of metabolic rate and cognitive function

For the purpose of comparing the indicators of metabolic rates and cognitive functions in 16 people working in sheltered conditions, a control group was selected ($n = 16$), which included residents of the same area. It is worth noting that there were no significant age differences across the two groups ($p < 0.41$). The participants were not currently employed under the conditions of a sheltered workshop or in the open labour market.

There were no differences found between the participants who were employed in sheltered work conditions and those receiving social support with regards to BMI ($p < 0.58$), waist circumference ($p < 0.13$) and lipid levels. Significant differences were observed with reference to the WHR indicator ($p < 0.01$). In terms of cognitive function, employed participants achieved better results in the STMS test measuring general cognitive functions ($p < 0.02$).

DISCUSSION

The assessment of psychosocial functioning showed that deficits of general cognitive function are associated with deterioration of the financial situation in patients suffering from mental illness, as well as with the need to use the support of others to meet the necessities of life.

This is due to the general nature of mental disorders, which is linked to a decline in the quality of life. It has been assumed that the lifespan of a person suffering from a psychiatric disorder is reduced by approximately 13–30 years when compared to a person who is not affected by a mental illness. Additionally, the mentally ill have been found to have an approximately 60% increased mortality rate due to various somatic factors (De Hert *et al.*, 2011b).

People with psychiatric disorders have a tendency to be more addicted to nicotine than people without psychiatric disorders (McNeill, 2001). These studies have shown that smoking results in a reduction of the overall cognitive function and verbal fluency, with this relationship being particularly evident in men. These results are in opposition to some studies, stressing that smoking improves cognitive functions, particularly

those in the range of attention (Ernst *et al.*, 2001). In our study, a positive correlation was observed between smoking and cognitive functions in direct memory, but only in men.

Nicotine is associated with transduction of certain neurotransmitters, such as noradrenaline, serotonin and dopamine. In some mental diseases, including schizophrenia, there is a disturbance in the economy of dopamine. Interestingly, dopamine receptors in the brain were found in areas relevant to schizophrenia along with other locations such as the prefrontal cortex, which is directly related to cognitive defects. Therefore, it can be explained why a person has a strong addiction to nicotine and at the same time is suffering from a psychiatric disorder, especially in those individuals who exhibit strong symptoms of their disease (Bidzan, 2007).

As mentioned in the introduction, individuals with psychiatric disorders often avoid physical activity, usually as a result of the symptoms of their underlying disease as well as their specific lifestyle (Zschucke *et al.*, 2013). Research that was conducted by Vancampfort *et al.* (2013) in a group of 80 patients diagnosed with schizophrenia indicated that low physical activity is associated with decreased cognitive function as well as an increase in the severity of depressive symptoms. In our study, we were also able to obtain similar results. Physically inactive people were characterised by greater severity of depressive symptoms, along with reduced cognitive function in terms of direct memory (Vancampfort *et al.*, 2013). Physical exercise has increasingly common use in the treatment of mild and moderate depression (Stanton and Reaburn, 2014). Research shows that exercise therapy has a beneficial effect on improving health, which is a strategy for dealing with stress and improving the quality of life. Therefore, besides standard pharmacotherapy in patients with depression, it is also recommended to include physical exercise in the treatment process (Knapen *et al.*, 2015). In the light of recent research, exercise therapy is recommended not only for the treatment of depression, but also therapy of other diseases, such as bipolar-disorder (Vancampfort *et al.*, 2015) and schizophrenia (Vancampfort *et al.*, 2013). Exercise therapy has a positive effect on the mood of patients. Experimental research performed by Beebe *et al.* (2005) showed that patients with schizophrenia who participated in a 16-week walking program showed significantly lower positive and negative symptoms of the underlying disease along with a reduction of their BMI and body fat. Exercise therapy reduces the risk of hypertension, cardiovascular disease, and type 2 diabetes (Mora *et al.*, 2007). Exercise also stimulates the processes of neuroplasticity of the brain by positively contributing to the function of the hippocampus, a structure necessary in the process of remembering and learning, which in turn, secondarily contributes to the prevention of mild cognitive impairment (Kandola *et al.*, 2016; Pajonk *et al.*, 2010).

Our own research has shown that the current employment status was associated with a lower indicator of abdominal obesity and better results in terms of general cognitive function. In a study by Dickerson *et al.* (2004) similar results

were obtained in a group with bipolar disorder. Current employment status was associated with better cognitive performance, especially in the category of direct verbal memory (Dickerson *et al.*, 2004).

On the basis of our own research we cannot conclude a causal relationship between the indicators of employment, cognitive function and metabolic rate. Possibly, employment is taken up by people whose psychophysical condition is better.

On the other hand, work can have a beneficial effect on the reduction of adipose tissue in the abdominal region, along with the improvement of cognitive function. The mechanism combining these two aspects can be seen with an improved self-esteem, mood and overall personal well-being (Bond, 2004). Recent studies carried out in patients suffering from depression emphasize that obesity also leads to accumulation of depressive symptoms. Also, depression can be a result of a dysregulated stress system, which may in the future lead to the accumulation of abdominal fat, which ultimately places the individual at an increased risk of developing CVD (Luppino *et al.*, 2010).

Undoubtedly, employment gives an individual the possibility of social interaction, which helps to organize personal time along with developing a sense of personal satisfaction from their own achievements. For the mentally ill, working seems to be something more than just means to earn money and to improve their existence. It forms an important part of the rehabilitation process of the underlying disease by improving cognitive and social function, whilst developing a positive influence on the improvement of the person's physical health condition (Waghorn *et al.*, 2010).

CONCLUSIONS

Multidimensional rehabilitation of psychiatric disorders including drug therapy, physical activity, social interaction and the possibility of employment in sheltered work conditions can advantageously contribute to the reduction of abdominal obesity, and decrease the severity of depressive symptoms. Additionally, it may reduce the number of hospitalisations along with having a positive impact on the ability of learning and memorisation.

Conflict of interest

The authors do not report any financial or personal links to other persons or organizations that might adversely affect the content of this publication and/or claim authorship rights thereto.

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